FRESHWATER BIOLOGICAL ASSOCIATION

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Bacterial Production of nitrate in aquatic systems

by

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NITRATE - LOSS PROCESSES IN RAW WATERS

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The importance of the oxidation of ammonia to nitrate (nitrification) in the nitrogen budget of lakes has already been established. Previous progress reports for this contract have described the quantification of this process both within and between lakes of different degrees of eutrophication. These data indicated that slight changes in methodology, particularly when investigating sediment deposits, could grossly affect the measured activity. The aim of the present research was an attempt to rationalize these differences. If this could be achieved it would enable meaningful interpretation of published data obtained using different methods and therefore enlarge the available database. In addition some observations have been made on the production of nitrite by Grasmere profundal sediment slurries sampled during the circulation period.

With the exception of studies performed at the contractors laboratory all investigations on the freshwater sediment nitrification process have involved the use of sediment slurry techniques. It therefore seemed most appropriate to study the effects of slurry preparation on the measured activity. The effects of substrate (ammonia) addition, dilution of the sediment and the diluent used have all been shown to affect ammonia oxidation. Moreover, illumination of the sediment during either retrieval from the lake or laboratory incubation also affects the activity measured. These data explain some of the observed differences between sediment slurry and intact sediment core derived nitrification rates and also some of the widely disparate results reported in the literature.

Investigation of nitrite production by slurries of profundal sediments from Grasmere showed that this was due to reductive processes rather than bacterial oxidation of ammonia which has previously been assumed. Further work revealed that nitrification did not occur in these sediments despite a well oxidised sediment-water interface. Comparative sampling during the circulation period, when all surface sediments are at the same temperature, indicated only in the oligotrophic environment did littoral and profundal sediments support similar rates of nitrification. Increasing eutrophication caused a decrease of activity in profundal sediments which could not be readily explained. These observations are important not only in the ecology of the nitrification process but also in the role of profundal sediments in the nitrogen budget of lakes and will therefore be extended after lake overturn later this year.

This contract is due for completion by March 1988.